

Appendix C
Parcel B Vapor Migration Model Results

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
MIGRATION FROM GROUNDWATER
BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L)	Cancer Risk	Hazard Index
71-43-2	Benzene	0.81	1.37E-10	0.00000022
75-15-0	Carbon disulfide	370	No Slope Factor	0.000052
56-23-5	Carbon tetrachloride	1.5	1.76E-09	0.0000029
71-55-6	Chloroform	5.1	1.2E-10	0.00000021
75-34-3	1,1-Dichloroethane (1,1-DCA)	0.35	2.84E-12	0.000000010
75-34-3	1,1-Dichloroethylene (1,1-DCE)	0.58	8.4E-10	0.00000067
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	12	No Slope Factor	0.0000035
100-41-4	Ethylbenzene	0.23	No Slope Factor	0.000000023
98-82-8	Isopropyl-benzene (cumene, 1-methylethyl b	0.32	No Slope Factor	0.0000025
75-09-2	Methylene Chloride	6	1.6E-11	0.00000012
78-93-3	Methyl Ethyl Ketone	5.6	No Slope Factor	0.00000000091
79-01-6	Tetrachloroethylene (PCE)	25	2.4E-09	0.000032
108-88-3	Toluene	17	No Slope Factor	0.0000011
79-01-6	Trichloroethylene (TCE)	10,000	2.8E-07	0.00045
95-63-6	1,2,4 - Trimethylbenzene	0.43	No Slope Factor	0.0000010
75-01-4	Vinyl chloride	3	8.21E-09	0.000011
1330-20-7	Xylenes	1.4	1.33E-10	0.0000018
Total			2.9E-07	0.00056

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.80E+04	mg/mole
Vapor pressure	VP	=	1.25E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	8.10E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.86E-01	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.20E+01	cm3/gm
Soil/water distribution coef.	K _d	=	2.48E-01	cm3/gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.86E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.80E-02	cm2/sec
Effective diffusion coefficient	D_e	=	7.06E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.39E-05	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	1.18E-07	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	1.18E-07	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	1.37E-09	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	3.85E-09	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.85E-09	mg/kg-day
Reference dose	RfD	=	1.71E-02	mg/kg-day
Hazard Index	HI	=	2.25E-07	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.37E-09	mg/kg-day
Slope factor (potency)	SF	=	1.00E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	1.37E-10	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Carbon disulfide**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.60E+04	mg/mole
Vapor pressure	VP	=	4.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.70E+02	ug/l
Henry's Law Constant	H	=	1.20E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	4.44E+02	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.20E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.60E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.84E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.44E+02 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	8.03E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	6.48E-02	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	3.20E-04	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	3.20E-04	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	3.72E-06	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.04E-05	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.04E-05	mg/kg-day
Reference dose	RfD	=	2.00E-01	mg/kg-day
Hazard Index	HI	=	5.22E-05	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.72E-06	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Carbon tetrachloride**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.50E+05	mg/mole
Vapor pressure	VP	=	1.51E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.50E+00	ug/l
Henry's Law Constant	H	=	1.20E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.80E+00	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.20E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.50E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.00E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.80E+00 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	6.26E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.05E-04	mg/m²-hour

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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	1.01E-06	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	1.01E-06	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	1.18E-08	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-08	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-08	mg/kg-day
Reference dose	RfD	=	1.14E-02	mg/kg-day
Hazard Index	HI	=	2.89E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.18E-08	mg/kg-day
Slope factor (potency)	SF	=	1.50E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	1.76E-09	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Chloroform**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.59E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.10E+00	ug/l
Henry's Law Constant	H	=	1.50E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	7.65E-01	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.12E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.65E-01 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	8.03E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.12E-04	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02 m2
% of floor area that flux occurs			1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	9.68E+00 m2
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.36E+03 m3
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	1.96E+03 m3/hr
Indoor air component	C _i	=	5.51E-07 mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	0.00E+00 m
Outdoor air component	C _o	=	0.00E+00 mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	5.51E-07 mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+01 m3/day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	2.50E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	1.25E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days

Chemical Intake (carc. risk)	IT _c	=	6.41E-09 mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.80E-08 mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.80E-08 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	2.09E-07

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.41E-09 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.22E-10

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** 1,1 - Dichloroethane (1,1-DCA)**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	3.08E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.50E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	8.05E-02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm3/gm
Soil/water distribution coef.	K _d	=	2.12E-01	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 8.05E-02 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02	cm2/sec
Effective diffusion coefficient	D_e	=	5.94E-03	cm2/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.69E-06	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	4.29E-08	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _i	=	4.29E-08	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	4.99E-10	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.40E-09	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.40E-09	mg/kg-day
Reference dose	RfD	=	1.40E-01	mg/kg-day
Hazard Index	HI	=	1.00E-08	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.99E-10	mg/kg-day
Slope factor (potency)	SF	=	5.70E-03	1/(mg/kg-day)
Cancer Risk	Risk	=	2.84E-12	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** 1,1-Dichloroethylene (1,1-DCE)**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.80E-01	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	6.38E-01	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.60E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.38E-01 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	7.22E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.38E-05	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02 m2
% of floor area that flux occurs			1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	9.68E+00 m2
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.36E+03 m3
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	1.96E+03 m3/hr
Indoor air component	C _i	=	4.14E-07 mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	m
Outdoor air component	C _o	=	0.00E+00 mg/m3

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	4.14E-07 mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+01 m3/day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	2.50E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	1.25E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days

Chemical Intake (carc. risk)	IT _c	=	4.81E-09 mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.35E-08 mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.35E-08 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
Hazard Index	HI	=	6.74E-07

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.81E-09 mg/kg-day
Slope factor (potency)	SF	=	1.75E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	8.41E-10

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** cis-1,2-Dichloroethylene (cis 1,2-DCE)**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	2.40E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.20E+01	ug/l
Henry's Law Constant	H	=	1.70E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	2.04E+00	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.70E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.60E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.44E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.04E+00 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	5.94E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.20E-04	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	1.09E-06	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	1.09E-06	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	1.26E-08	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	3.55E-08	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.55E-08	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	HI	=	3.55E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.26E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.30E-01	ug/l
Henry's Law Constant	H	=	3.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	7.36E-02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm3/gm
Soil/water distribution coef.	K _d	=	8.00E-01	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.36E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02	cm2/sec
Effective diffusion coefficient	D_e	=	6.02E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.05E-06	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	3.98E-08	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	3.98E-08	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	4.62E-10	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-09	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-09	mg/kg-day
Reference dose	RfD	=	5.71E-01	mg/kg-day
Hazard Index	HI	=	2.27E-09	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.62E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Isopropyl-benzene (cumene, 1-methylethyl benzene)**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.92E-03	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.20E-01	ug/l
Henry's Law Constant	H	=	4.90E+01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.57E+01	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.90E+01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.20E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	8.80E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.57E+01 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	6.02E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.72E-03	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	8.47E-06	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	8.47E-06	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	9.85E-08	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	2.76E-07	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.76E-07	mg/kg-day
Reference dose	RfD	=	1.10E-01	mg/kg-day
Hazard Index	HI	=	2.51E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.85E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Methylene Chloride**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	5.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	6.00E+00	ug/l
Henry's Law Constant	H	=	9.00E-02	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	5.40E-01	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	9.00E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.00E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	4.00E-02	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 5.40E-01 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	8.03E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	7.88E-05	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02 m2
% of floor area that flux occurs			1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	9.68E+00 m2
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.36E+03 m3
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	1.96E+03 m3/hr
Indoor air component	C _i	=	3.89E-07 mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	0.00E+00 m
Outdoor air component	C _o	=	0.00E+00 mg/m3

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	3.89E-07 mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+01 m3/day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	2.50E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	1.25E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days

Chemical Intake (carc. risk)	IT _c	=	4.52E-09 mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.27E-08 mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.27E-08 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
Hazard Index	HI	=	1.15E-07

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.52E-09 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	1.58E-11

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Methyl Ethyl Ketone**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil > 100 mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.20E+04	mg/mole
Vapor pressure	VP	=	1.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.60E+00	ug/l
Henry's Law Constant	H	=	1.10E-03	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	6.16E-03	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E-03	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.50E+00	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.80E-02	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.16E-03 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	7.22E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.09E-07	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	3.99E-09	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	3.99E-09	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	4.64E-11	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-10	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-10	mg/kg-day
Reference dose	RfD	=	1.43E-01	mg/kg-day
Hazard Index	HI	=	9.12E-10	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.64E-11	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

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Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil > 100 mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.50E+01	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.88E+01	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.08E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.88E+01 mg/m³

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	5.78E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.97E-03	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	9.72E-06	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	9.72E-06	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	1.13E-07	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	3.17E-07	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.17E-07	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	HI	=	3.17E-05	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.13E-07	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	2.37E-09	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.70E+01	ug/l
Henry's Law Constant	H	=	2.70E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	4.59E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.70E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm3/gm
Soil/water distribution coef.	K _d	=	5.60E-01	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.59E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02	cm2/sec
Effective diffusion coefficient	D_e	=	6.98E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	5.82E-04	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C_i	=	2.88E-06	mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C_o	=	0.00E+00	mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

C_t	=	2.88E-06	mg/m³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT_c	=	3.34E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.38E-08	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.38E-08	mg/kg-day
Reference dose	RfD	=	8.57E-02	mg/kg-day
Hazard Index	HI	=	1.09E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.34E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Trichloroethylene (TCE)**Variable Descriptions****Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.00E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	4.20E+03	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.76E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.20E+03 mg/m³**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	6.34E-03	cm²/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	4.84E-01	mg/m²-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
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SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	2.39E-03	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	2.39E-03	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	2.78E-05	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	7.79E-05	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.79E-05	mg/kg-day
Reference dose	RfD	=	1.71E-01	mg/kg-day
Hazard Index	HI	=	4.55E-04	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.78E-05	mg/kg-day
Slope factor (potency)	SF	=	1.00E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	2.78E-07	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2,4 - Trimethylbenzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil > 100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.76E-03	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	4.30E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	9.89E-02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.70E+03	cm3/gm
Soil/water distribution coef.	K _d	=	1.48E+01	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 9.89E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02	cm2/sec
Effective diffusion coefficient	D_e	=	6.02E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.08E-05	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	5.34E-08	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	5.34E-08	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	6.21E-10	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.74E-09	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.74E-09	mg/kg-day
Reference dose	RfD	=	1.70E-03	mg/kg-day
Hazard Index	HI	=	1.02E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.21E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

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Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl chloride

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	6.30E+04	mg/mole
Vapor pressure	VP	=	3.50E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.00E+00	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	3.30E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.90E+01	cm3/gm
Soil/water distribution coef.	K _d	=	7.60E-02	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 3.30E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.10E-01	cm2/sec
Effective diffusion coefficient	D_e	=	8.83E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	5.29E-04	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m2
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C _i	=	2.61E-06	mg/m3

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m3

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	2.61E-06	mg/m3
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	3.04E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	8.53E-08	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.53E-08	mg/kg-day
Reference dose	RfD	=	7.43E-03	mg/kg-day
Hazard Index	HI	=	1.15E-05	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.04E-08	mg/kg-day
Slope factor (potency)	SF	=	2.70E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	8.21E-09	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.40E+00	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.05E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K _d	=	1.08E+00	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.05E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	D_e	=	5.78E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.10E-04	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	5.45E-07	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION

C _t	=	5.45E-07	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	6.33E-09	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	1.78E-08	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.78E-08	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	HI	=	1.78E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.33E-09	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	1.33E-10	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc
tables_secondtable

CHEMICAL PARAMETERS

CAS No.		MW (mg/mole)	H' (dimension- less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)
71-43-2	Benzene	7.8E+04 a	2.3E-01 a	8.8E-02 a	1.2E-01	25 b	6.2E+01 a	1.8E+03 a	1.00E-01	1.71E-02
75-15-0	Carbon disulfide	7.6E+04 a	1.2E+00 a	1.0E-01 a	4.7E-01	25 b	4.6E+01 a	1.2E+03 a	0.00E+00	2.00E-01
56-23-5	Carbon tetrachloride	1.5E+05 a	1.2E+00 a	7.8E-02 a	1.5E-01	25 b	1.5E+02 a	7.9E+02 a	1.50E-01	1.14E-02
67-66-3	Chloroform	1.2E+05 a	1.5E-01 a	1.0E-01 a	2.6E-01	25 b	5.3E+01 a	7.9E+03 a	1.9E-02 c	8.6E-02 e
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04 a	2.3E-01 a	7.4E-02 a	3.1E-01	25 b	5.3E+01 a	5.1E+03 a	5.70E-03	1.40E-01
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04 a	1.1E+00 a	9.0E-02 a	7.8E-01	25 b	6.5E+01 a	2.3E+03 a	1.75E-01	2.00E-02
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04 a	1.7E-01 a	7.4E-02 a	2.4E-04	20 b	3.6E+01 a	3.5E+03 a	0.00E+00	1.00E-02
100-41-4	Ethylbenzene	1.1E+05 a	3.2E-01 a	7.5E-02 a	1.3E-02	25 b	2.0E+02 a	1.7E+02 a	0.00E+00	5.71E-01
98-82-8	Isopropyl-benzene (cumene, 1-methylethyl benzene)	1.2E+05 a	4.9E+01 a	7.5E-02 a	5.9E-03	25 b	2.2E+02 a	6.1E+01 a	0.00E+00	1.10E-01
75-09-2	Methylene Chloride	8.5E+04 a	9.0E-02 a	1.0E-01 a	5.7E-01	25 b	1.0E+01 a	1.3E+04 a	3.5E-03 c	1.1E-01 e
78-93-3	Methyl Ethyl Ketone	7.2E+04 a	1.1E-03 a	9.0E-02 a	1.2E-01	25 b	4.5E+00 a	2.7E+05 a	0.00E+00	1.43E-01
127-18-4	Tetrachloroethylene (PCE)	1.7E+05 a	7.5E-01 a	7.2E-02 a	2.4E-02	25 b	2.7E+02 a	2.0E+02 a	2.1E-02 c	1.0E-02 e
108-88-3	Toluene	9.2E+04 a	2.7E-01 a	8.7E-02 a	3.7E-02	25 b	1.4E+02 a	5.3E+02 a	0.00E+00	8.57E-02
79-01-6	Trichloroethylene (TCE)	1.3E+05 a	4.2E-01 a	7.9E-02 a	7.6E-02	20 b	9.4E+01 a	1.1E+03 a	1.00E-02	1.71E-01
95-63-6	1,2,4 - Trimethylbenzene	1.2E+05 a	2.3E-01 a	7.5E-02 a	2.8E-03	25 b	3.7E+03 a	2.6E-01 a	0.00E+00	1.70E-03
75-01-4	Vinyl chloride	6.3E+04 a	1.1E+00 a	1.1E-01 a	3.5E+00	25 b	1.9E+01 a	2.8E+03 a	2.70E-01	7.43E-03
1330-20-7	Xylenes	1.1E+05 a	3.0E-01 a	7.0E-02 a	1.1E-02	25 b	2.0E+02 a	1.6E+02 a	0.00E+00	2.00E-01

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf

e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
MIGRATION FROM GROUNDWATER AFTER CHEMICAL LEACHING TO GROUNDWATER
BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L greater that 12 feet)	Cancer Risk	Hazard Index
75-35-4	1,1-Dichloroethylene (1,1-DCE)	2.6	3.8E-09	0.0000030
127-18-4	Tetrachloroethylene (PCE)	0.29	2.8E-11	0.00000037
108-88-3	Toluene	0.27	No Slope Factor	0.000000017
79-01-6	Trichloroethlyene (TCE)	15	4.2E-10	0.00000068
Total			4.2E-09	0.0000041

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil > 100 mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.60E+00	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	2.86E+00	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.60E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.86E+00 mg/m³

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	7.22E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	3.75E-04	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	1.85E-06	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.85E-06	mg/m³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	hrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	2.16E-08	mg/kg-day
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Chemical Intake (non-carc. risk)	IT _{nc}	=	6.05E-08	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.05E-08	mg/kg-day
Reference dose	RfD	=	2.00E-02	mg/kg-day
Hazard Index	HI	=	3.02E-06	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.16E-08	mg/kg-day
Slope factor (potency)	SF	=	1.75E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	3.77E-09	

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.90E-01	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	2.18E-01	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K _d	=	1.08E+00	cm3/gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.18E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	D_e	=	5.78E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.28E-05	mg/m2-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C_i	=	1.13E-07	mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C_o	=	0.00E+00	mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

C_t	=	1.13E-07	mg/m³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT_c	=	1.31E-09	mg/kg-day
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Chemical Intake (non-carc. risk)	IT_{nc}	=	3.68E-09	mg/kg-day
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NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.68E-09	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	HI	=	3.68E-07	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.31E-09	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	2.75E-11	

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil > 100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.70E-01	ug/l
Henry's Law Constant	H	=	2.70E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	7.29E-02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.70E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm3/gm
Soil/water distribution coef.	K _d	=	5.60E-01	cm3/gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.29E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02	cm2/sec
Effective diffusion coefficient	D_e	=	6.98E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F_x	=	9.25E-06	mg/m2-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C_i	=	4.57E-08	mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C_o	=	0.00E+00	mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

C_t	=	4.57E-08	mg/m³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT_c	=	5.31E-10	mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.49E-09	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.49E-09	mg/kg-day
Reference dose	RfD	=	8.57E-02	mg/kg-day
Hazard Index	HI	=	1.74E-08	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.31E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor	

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil > 100 mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m ³ /mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m³

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.50E+01	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	6.30E+00	mg/m³

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.50E+00	gm/cc
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Water-filled porosity	θ _w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.76E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m³

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=		mg/m³ (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.30E+00 mg/m³

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ _a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	6.34E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	7.26E-04	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	9.68E+02	m ²
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02	dimensionless
Flux area within building	A _f	=	9.68E+00	m ²
Interior Height of building	R _h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m ³
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m ³ /hr
Indoor air component	C _i	=	3.58E-06	mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	C _o	=	0.00E+00	mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	3.58E-06	mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m ³ /day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	=	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion	=	2.50E+00	days/week
Weeks per year	conversion	=	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days

Chemical Intake (carc. risk)	IT _c	=	4.17E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.17E-07	mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.17E-07	mg/kg-day
Reference dose	RfD	=	1.71E-01	mg/kg-day
Hazard Index	HI	=	6.82E-07	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.17E-08	mg/kg-day
Slope factor (potency)	SF	=	1.00E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	4.17E-10	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

CHEMICAL PARAMETERS

	MW (mg/mole)	H ⁺ (dimension- less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)
CAS No.									
127-18-4 Tetrachloroethylene (PCE)	1.7E+05 a	7.5E-01 a	7.2E-02 a	2.4E-02	25 b	2.7E+02 a	2.0E+02 a	2.1E-02	1.0E-02
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04 a	1.1E+00 a	9.0E-02 a	7.8E-01	25 b	6.5E+01 a	2.3E+03 a	1.75E-01	2.00E-02
108-88-3 Toluene	9.2E+04 a	2.7E-01 a	8.7E-02 a	3.7E-02	25 b	1.4E+02 a	5.3E+02 a	0.00E+00	8.57E-02
79-01-6 Trichloroethylene (TCE)	1.3E+05 a	4.2E-01 a	7.9E-02 a	7.6E-02	20 b	9.4E+01 a	1.1E+03 a	1.00E-02	1.71E-01

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf

e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, <http://www.arb.ca.gov/ab2588/riskassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, <http://www.arb.ca.gov/ab2588/riskassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.